

SUPPORTING WINDOWS 2000 PROFESSIONAL

In this chapter, you will learn:

- ◆ About the different operating systems within the Windows 2000 suite
- ◆ About the differences and similarities among Windows 98, Windows NT, and Windows 2000 Professional
- ◆ How to install Windows 2000 Professional
- ◆ About the Windows 2000 boot process, management tools, and problem-solving tools
- ◆ How to troubleshoot problems with Windows 2000

Windows 2000 is the culmination of the evolution of Microsoft operating systems from the 16-bit DOS operating system to a true 32-bit, module-oriented operating system complete with desktop functionality, user-friendly Plug and Play installations, and other easy-to-use features. As a personal computer operating system, Windows 2000 is the next generation of Windows NT Workstation. While taking advantage of the user-friendly features of Windows 98, Windows 2000 is founded on the new technology of Windows NT, and is committed to leaving behind the compromises Windows 9x made with legacy hardware and applications software. In addition, Windows 2000 introduces many new features, including a new approach to managing hard drive storage, called dynamic storage. This chapter looks at the similarities and differences among Windows 98 discussed in Chapter 12, Windows NT Workstation discussed in Chapter 13, and Windows 2000. You will learn about Windows 2000, how it manages hardware and software, and how you can support it. Windows 2000 is really a suite of operating systems, each designed for a different size computer and level of computing needs. We first turn our attention to an overview of each operating system before we begin a detailed study of Windows 2000 Professional, the operating system designed for personal computers.

SUITE OF OPERATING SYSTEMS

Windows 2000 is a series of operating systems, each designed for a particular size computer and type of computing needs. Windows 2000 includes four operating systems:

- **Windows 2000 Professional** This OS is designed to ultimately replace both Windows 98 and Windows NT Workstation as a personal computer desktop OS in a business environment. It is an improved version of Windows NT Workstation, using the same kernel approach to hardware and software, and includes all the popular features of Windows 98. Some of the new features include Plug and Play, a Control Panel with an Add/Remove Hardware icon, an improved backup utility, a FAT32 file system, virtual private network support, and improved security features. Windows 2000 Professional works well as an OS for notebook computers, with excellent power management features. The minimum system requirements are 133 MHz Pentium-compatible CPU, 64 MB RAM, and 650 MB hard drive storage. Recommended requirements are 300 MHz Pentium-compatible CPU, 128 MB of RAM, and 2 GB hard drive storage.
- **Windows 2000 Server** This OS is the improved version of Windows NT Server and is designed as a network operating system for low-end servers. Just as with Windows NT Server, Windows 2000 Server can be a domain controller for a network and is a powerful file server and printer-sharing server. It is intended to be used in a small business environment as the network operating system for a small LAN. The minimum system requirements are 133 MHz Pentium-compatible CPU, 256 MB RAM, and 1 GB hard drive storage. Recommended requirements are 400 MHz Pentium-compatible CPU, 256 MB of RAM, and 2 GB hard drive storage.
- **Windows 2000 Advanced Server** This network operating system has the same features as Windows 2000 Server, but is designed to run on more powerful servers. Windows 2000 Advanced Server supports up to eight processors in a single system and up to 8 GB of memory. It is designed to support high volumes of users and complex applications in e-commerce and medium-size business environments. The minimum system requirements are 133 MHz Pentium-compatible CPU, 256 MB RAM, and 1 GB hard drive storage. Recommended requirements depend on how the system is used.
- **Windows 2000 Datacenter Server** This network operating system is another step up from Windows 2000 Advanced Server and is designed to support up to 32 processors and 64 GB of memory. It is intended to be used in large enterprise operations centers such as those needed to support data warehousing, Internet service providers (ISPs), and application service providers (ASPs). The minimum and recommended requirements depend on how the system is used.

Table 14-1 shows the maximum number of CPUs supported in a single system and the maximum amount of memory supported by the four operating systems. Hardware and software must qualify for all the Windows 2000 products just as they must qualify for Windows NT. For hardware, check the Hardware Compatibility List at www.microsoft.com/hcl. For software applications, search the list of compatible software applications list at www.microsoft.com/windows2000/upgrade/compat.

Table 14-1 Comparing Windows 2000 products

Description	Windows 2000 Professional	Windows 2000 Server	Windows 2000 Advanced Server	Windows 2000 Datacenter Server
Maximum RAM supported	4 GB	4 GB	8 GB	64 GB
Maximum CPUs in one system	2	4	8	32

Microsoft has announced intentions to market a home personal computer version of Windows 2000, which is expected to replace Windows 98 in the personal computer market for low to mid-range systems. The suite of Windows 2000 operating systems will ultimately replace all Windows NT and Windows 9x operating systems.

COMPARING WINDOWS 2000 TO WINDOWS NT AND WINDOWS 98

A⁺OS 1.1 This section looks at the differences between Windows 2000 and its predecessor, Windows NT, and also compares Windows 2000 to Windows 98.

Windows 2000 and Windows 98

A⁺OS 1.1 Windows 2000 was built on Windows NT and is basically the next evolution of Windows NT with the added user-friendly features of Windows 98. Windows 2000 Professional is probably the best choice of operating systems for the business or corporate desktop computer, and Windows 98 the best choice for home users. Because of the power management improvements Windows 2000 has over Windows 98, Windows 2000 is the best choice for notebook computers. For the business environment, Windows 2000 offers better support for very large hard drives, more security, and better reliability. For home users, Windows 98 works best with games, music, and video, and offers the best support for the most hardware and software products.

Windows 2000 is more reliable than Windows 98. Recall that Windows 98 is a combination 16-bit and 32-bit operating system, but Windows 2000 is a true 32-bit OS. Windows 2000 supports true multithreading and isolates 32-bit applications in different processes so that one bad application cannot hang the entire system. When Windows 2000 installs an application, it keeps separate versions of the application DLLs so that two applications that use a DLL with the same name can coexist on a system. By comparison, Windows 98 allows one application to overwrite the DLL files of another. Drivers and Windows system files under Windows 2000 are protected from being altered by applications and users, which prevents corruption and improves system reliability. By contrast, Windows 98 does not always ask for your permission before allowing an application to alter or overwrite a critical system file. Also, Windows 2000 has some new tools to help application developers build installation disks for their products and troubleshoot application problems. One of these products is Dependency Walker, which is discussed later in the chapter.

A⁺ OS 1.1 Windows 2000 offers better security than previous operating systems. The NTFS file system inherited from Windows NT gives better security. Windows 2000 has its own data encryption system and uses Kerberos (a security standard) to encrypt a user ID and password as the user logs on to the network from a Windows 2000 workstation. None of these features are available under Windows 98.

Although both Windows 2000 and Windows 98 use Plug and Play, the Windows 2000 version is significantly advanced over that of Windows 98. You will learn more about Windows 2000 Plug and Play later in the chapter. Windows 2000 includes a personalized Start menu that only shows the applications used most often so that the menus are not cluttered with applications seldom used. See Figure 14-1. The down arrows indicate that more applications are in the list but are hidden from view. To see these applications, hold your cursor over the menu for a brief moment.

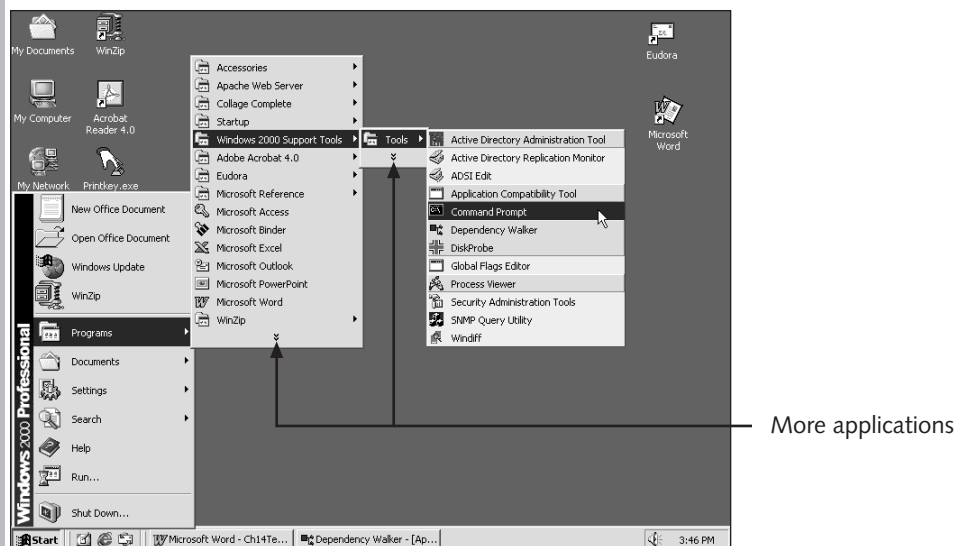


Figure 14-1 The Windows 2000 personalized Start menu does not initially show applications that are not often used

As with Windows NT, Windows 2000 has an advantage over Windows 98 when deploying the operating system over multiple desktop computers in a corporate or educational setting. Windows 2000 has built-in disk duplication support so that you can copy the OS from one hard drive to another with a minimum of interaction. Also, you can perform unattended installations, meaning you can install the OS to a computer from across a network without interacting with the software. Windows 2000 also has new support tools for troubleshooting problems with the OS.

Windows 2000 and Windows 98 use Advanced Configuration and Power Interface (ACPI), which enables a computer to power down unused devices to conserve power, and gives the user much more control over power to the system. The Windows 2000 features for ACPI are improved over those of Windows 98. Both require the cooperation of ACPI-compliant system BIOS. For example, on a PC with ACPI BIOS, to set the Power Options of Windows 2000,

A⁺ OS 1.1 open the **Control Panel** shown in Figure 14-2. Double-click the **Power Options** icon. The Power Options Properties dialog box opens. Click the **Advanced** tab (see Figure 14-3). From the list of power options, select what will happen when you press the power button on your computer case. For example, you can set the computer to change to Standby mode when you press the power button. On the Hibernate tab, you can also control when and how the system goes into hibernation. On the UPS tab, you can control and monitor an intelligent UPS device, if one is attached.

ACPI specifications were developed by Compaq, Intel, Microsoft, Phoenix, and Toshiba to allow for reliable power management through hardware and software cooperation. For more information about ACPI, see www.teleport.com/~acpi.

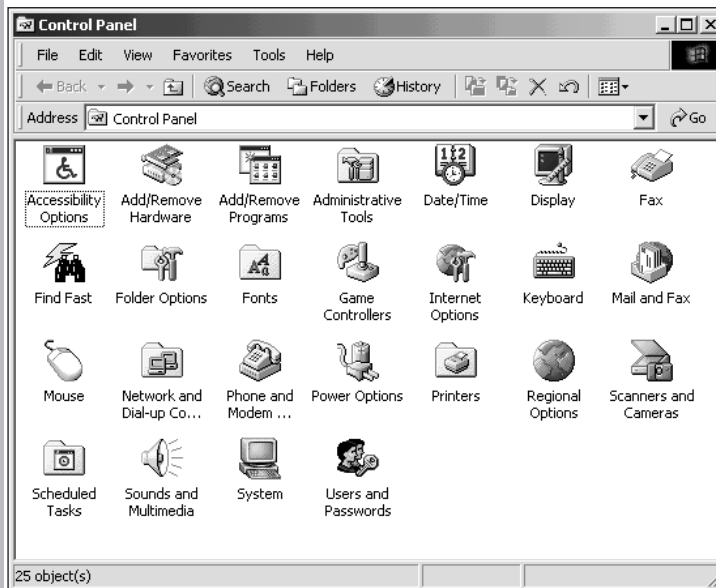


Figure 14-2 Windows 2000 Control Panel

Also notice in Figure 14-2 that the Network and Dial-Up Connections and Scheduled Tasks icons are in the Windows 2000 Control Panel rather than in the My Computer window of Windows 98. This is a much more logical place to put them because they control system resources.



A user might forget their Windows 2000 password. If you have Administrator privileges, you can reset a password using the Users and Passwords icon in Control Panel. Double click on the icon, select a user from the list of users and click Set Password.

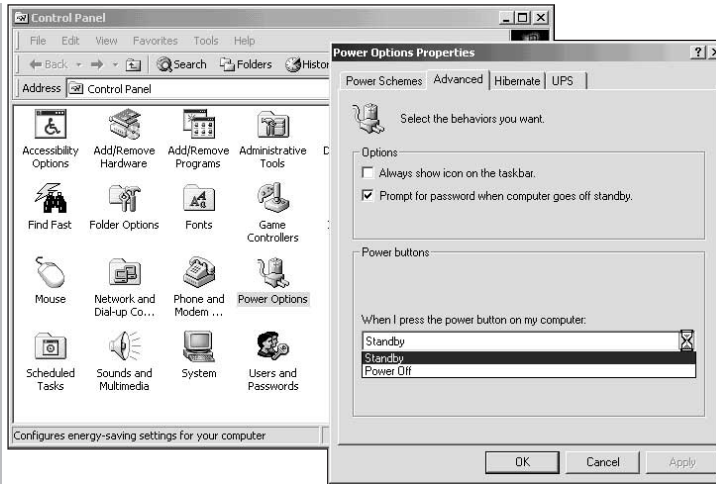
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Figure 14-3 Windows 2000 offers several features to control power available from the Power Options icon of Control Panel

Another major change in how windows are accessed to control resources is the window to identify a computer on a network. In Windows 98, to name the computer on a network, you open the Network Properties dialog box and click the **Identification** tab. (Recall that to access the Network Properties window in Windows 98, you right-click the Network Neighborhood icon and select Properties from the shortcut menu.) With Windows 2000, to assign a name to your computer on a network, you use the System Properties dialog box. To access the window, you can right-click the **My Computer** icon on the desktop or you can double-click the **System** icon in Control Panel. The System Properties dialog box opens, as shown in Figure 14-4. Click the **Network Identification** tab to view and change the computer name and to join a workgroup or domain.

Computer names are also different in Windows 2000. Windows 9x and Windows NT assume that a computer is using NetBIOS for applications to access resources on a network and, therefore, assume that this computer name is a NetBIOS name. A NetBIOS name can have up to 15 characters, for example, joesmith. NetBIOS is being replaced by another application programming interface (API) called Windows Sockets (WinSock for short) that uses domain names, the name convention used on the Internet. Windows 2000 assumes that a computer name is a domain name, which uses a hierarchical format such as joesmith.mycompany.com.

Accessing Device Manager is also different under Windows 2000. From the Control Panel, double-click the **System** icon. The System Properties dialog box opens (see Figure 14-5). Click the **Hardware** tab, and then click the **Device Manager** button. The Device Manager window opens (see Figure 14-6). Right-click a device to view its Properties dialog box. Figure 14-6 shows the Properties dialog box for a modem. Each hardware Properties dialog box provides access to the Windows 2000 Troubleshooter for that device.

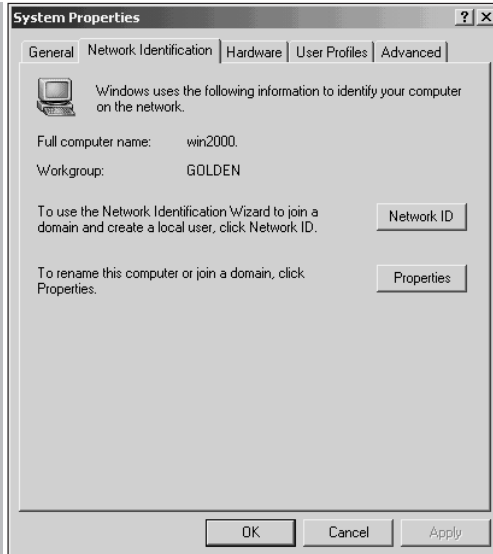
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Figure 14-4 The Network Identification tab is a part of the System Properties dialog box of Windows 2000

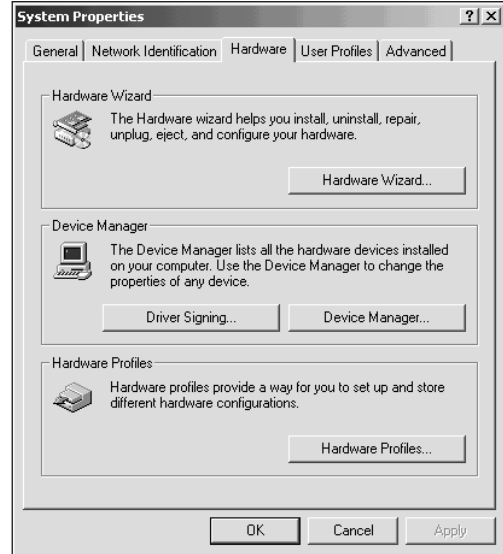


Figure 14-5 Use the Hardware tab of the System Properties dialog box to access Device Manager

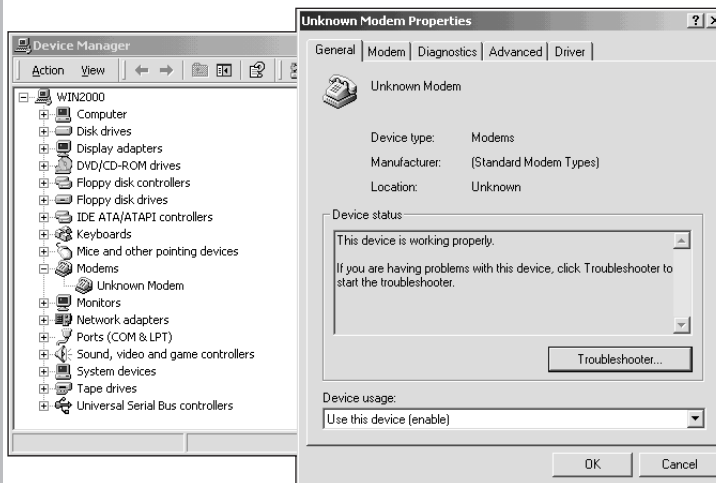


Figure 14-6 Device Manager and a hardware Properties dialog box

A+ OS 1.1 The Troubleshooter is more comprehensive than Windows 98 or Windows NT (see Figure 14-7). Use it for suggestions of things to do and try to resolve problems with hardware.

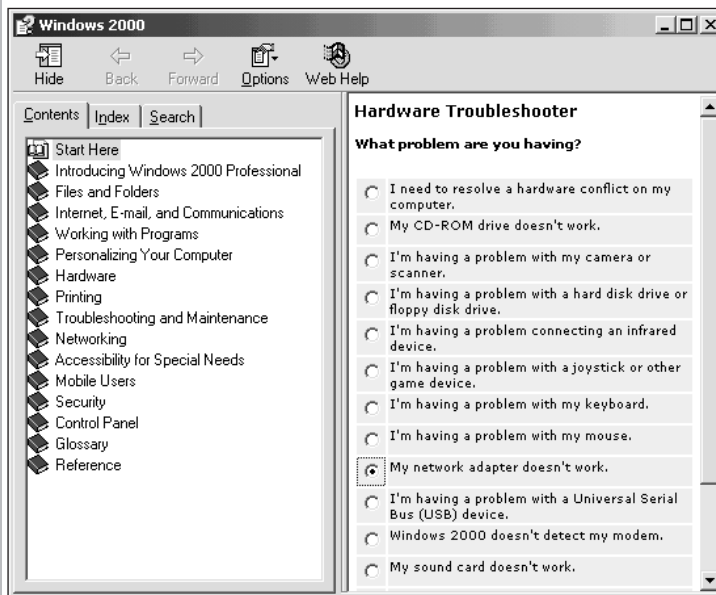


Figure 14-7 Windows 2000 has a comprehensive Troubleshooter

Because Windows 2000 uses NT technology, it does not support 16-bit legacy device drivers, nor does it support all legacy devices or software. If you have a legacy application or device, you might have to use Windows 98. To determine if your hardware and software qualify for Windows 2000, see the Microsoft web site. You will learn more about the process later in the chapter.

Windows 2000, as well as Windows 98 and Windows NT offer user profiles that allow the system to restore user preferences each time a user logs onto the system. A user profile can include software and hardware settings such as how the desktop displays, what shortcuts are on the desktop and what printers or other hardware devices are available for a user. When several users use the same computer, user profiles can be a handy way for each user to keep individual settings. Also, on a network, a roaming profile follows the user from computer to computer on the network. Users profiles can be collected into a group profile so that changes to the group profile affect all users assigned to that group.

Windows 2000 for Notebook Computers

The following features are available for notebook computers using Windows 2000, but are not a part of Windows 98:

- A feature called Offline Files and Folders allows you to download files and folders from a network to the PC so you can work on them offline. When the PC is later connected to the network, the files and folders can be uploaded to the network so that any changes are kept current on the network.
- The technology is included in Windows 2000 to allow a notebook to connect to a virtual private network (VPN) so that a user can work from home and connect to the corporate network over the Internet in a secure connection. To do this, Windows 2000 encrypts data before it is transmitted over the Internet using Point-to-Point Tunneling Protocol (PPTP), Layer Two Tunneling Protocol (L2TP), and Internet Protocol security (IPSec).
- The power management features of Windows 2000 are enhanced and improved over those of Windows 98.

In summary, Windows 2000 Professional is designed as a desktop computer operating system for a large network in a corporate or educational environment. Windows 98 is best used on a PC in a home or on a small network. Finally, for a notebook computer, Windows 2000 is the best choice.

Windows 2000 and Windows NT

A⁺ OS 1.1, 3.1, 3.2 Windows 2000 is the next upgrade of Windows NT. It contains the same core technology and provides a number of new capabilities. Windows 2000 supports the FAT16, FAT32, and the NTFS file systems. The Windows 2000 registry is organized and edited the same way as the Windows NT registry. Utilities, such as Event Viewer and Dr. Watson, also work the same way with major changes. It provides an encrypted file system for added security and support for virtual private networks. Windows 2000 Help and Troubleshooter utilities are much more comprehensive than the Windows NT or Windows 98 utilities. Windows 2000 supports multiple monitors, IEEE 1394 (FireWire), USB, and ACPI. Network Neighborhood is replaced by My Network Places, which intelligently shows recently visited network resources and lets you assign user-friendly names to these resources. See Figure 14-8.

Recall that Windows NT does not support Plug and Play. Windows 2000 uses an advanced version of Plug and Play that does all the work for configuring a system and does not use the Plug and Play programs in system BIOS.

Another feature new to Windows 2000 is **Active Directory**, a service that allows for a single point of administration for all shared resources on a network. Active Directory can track the location of files; peripheral devices, including printers; scanners, and other hardware; databases; web sites; users; services; and so forth. It uses a locating method similar to that used by the Internet. Windows 2000 Server provides Active Directory, and Windows 2000 Professional acts as an Active Directory client, or user of the directory.

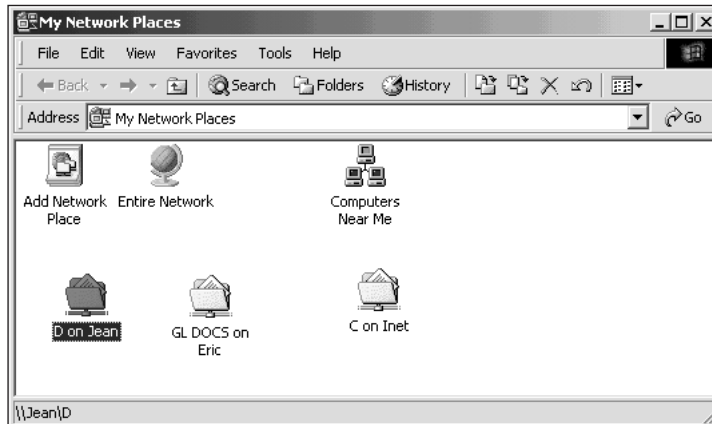


Figure 14-8 My Network Places window intelligently shows resources recently visited

Recall from Chapter 13 that a Windows NT client/server network has one primary domain controller and may have one or more backup domain controllers. A Windows NT network can have no more than one primary domain controller, which maintains the only copy of the directory database that can be edited. When the directory database is changed, such as when a new user is added to the network, only the directory database on the primary domain controller is updated. The directory databases on the backup domain controllers are updated by the primary domain controller. With Windows 2000, a network can have any number of domain controllers, each keeping a copy of the directory that can be edited (see Figure 14-9). An administrator can update the directory on any one of these domain controllers, which will then communicate the change to the other domain controllers on the network.

When both Windows NT and Windows 2000 domain controllers are on the same network, conflicts can result because of the differences in the way the domain controllers work. For this reason, Windows 2000 runs in two modes, mixed mode and native mode. **Native mode** is used when no Windows NT domain controllers are present and **mixed mode** is used when there is at least one Windows NT domain controller on the network. Mixed mode is necessary in a situation where a large network is being upgraded from Windows NT to Windows 2000, and some servers have received the upgrade but others have not.

Windows 2000 includes several new diagnostic and recovery tools, including Recovery Console, Safe Mode (similar to Windows 98 Safe Mode), and File Protection (which prevents system files from being corrupted or erased). For backups, Windows NT provides a backup utility to tape only, but Windows 2000 allows backups to tape, Zip drives, recordable CD-ROMs, and external hard drives. Windows 2000 uses the **Internet Printing Protocol (IPP)**, so users can print directly to a printer's URL anywhere on the Internet. In addition, several other features new to Windows 2000 are designed to support and improve Internet services to users.

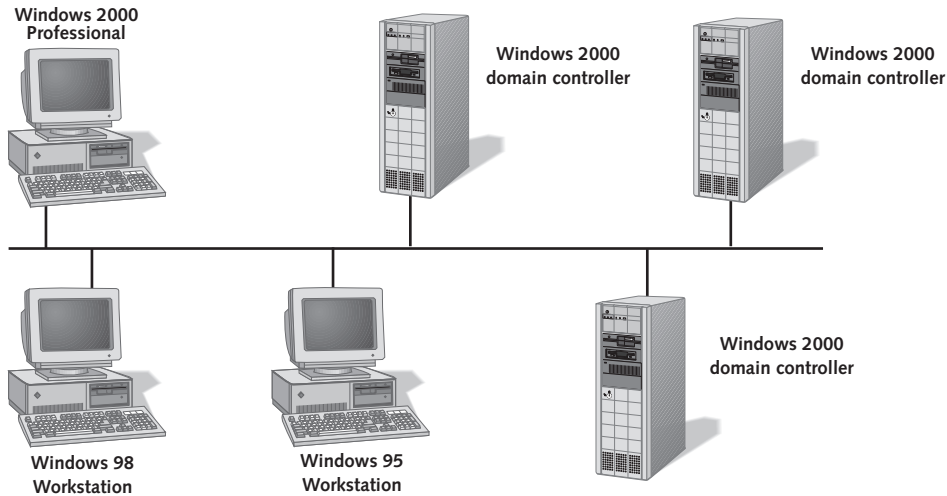


Figure 14-9 Windows 2000 allows for multiple domain controllers, each keeping a read/write copy of the domain database

Windows 2000 offers two ways to configure a hard drive: basic disk and dynamic disk. Basic disk is the same as the configuration used with DOS, Windows 9x, and Windows NT. By default, Windows 2000 uses basic disk configuration. Dynamic disks don't use partitions or logical drives. Data to configure the disk is stored in a disk management database that resides in the last 1 MB of storage space at the end of a hard drive. Dynamic disks cannot be read by DOS, Windows 9x, or Windows NT.

A dynamic volume is contained within a dynamic disk and is a logical volume similar to a logical drive in a basic disk. It can be used as one of several volumes that makes up a striped volume set. A striped volume is a way of writing data across several hard drives as though they were a single drive. The purpose of striped volumes is to increase the overall size of the storage space, making several hard drives appear as one logical drive to a system. Striped volumes have been around for a long time, but dynamic disks are a new way that Windows 2000 implements these striped volumes and allows for other methods of providing redundancy and very large amounts of hard drive storage.

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Another feature new to Windows 2000 is Encrypting File System (EFS). EFS can only be used with the NTFS file system, and uses a public key encryption method to encrypt files and folders. Public key encryption requires a public key installed on the computer doing the encryption and a private key on the computer decrypting the files. If the files are encrypted and then decrypted on the same computer, it must have both the public and private key. A public or private key is binary data stored in the Windows Registry that belongs to a single user; it's the user's responsibility to protect a key.

To encrypt a folder or file, using Windows Explorer, right-click on the file or folder name and select **Properties** from the shortcut menu. Select the **General** tab and click the **Advanced** button. Select **Encrypt contents to secure data**.

INSTALLING WINDOWS 2000 PROFESSIONAL

A+ OS 2.2 This section looks at installing Windows 2000 on a system with a newly installed hard drive, called a **clean installation**, and also installing Windows 2000 as an upgrade from Windows 9x or Windows NT, called an **upgrade installation**. Also, just as with Windows NT, Windows 2000 can be installed to be dual-booted with another OS. As you read the following instructions, notice the similarities to the installation process for Windows NT Workstation discussed in Chapter 13.

Plan the Installation

Windows 2000 has its roots in Windows NT. Just as with Windows NT, it does not use system BIOS to interface with hardware devices. For that reason, a hardware device must be designed to specifically interact with Windows 2000. Use the Hardware Compatibility List (HCL) to determine if all the hardware devices in your system qualify for Windows 2000. A version of the HCL is on the Windows 2000 CD in the \Support folder. See Figure 14-10. However, the list is constantly being updated. To see the latest version of the list, check the Microsoft web site at www.microsoft.com/hcl. Don't assume that because a device is compatible with Windows NT, it will work with Windows 2000. There are some instances in which this is not the case, so check the HCL for Windows 2000 to be sure.

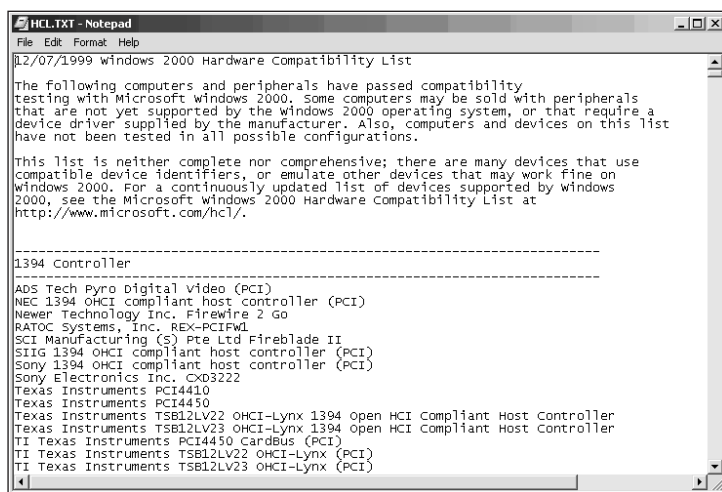


Figure 14-10 Before installing Windows 2000, verify that hardware devices qualify by checking the Hardware Compatibility List (HCL)

Software applications must also qualify for Windows 2000. To verify that all the applications you intend to use on the Windows 2000 PC are certified to work with Windows 2000, search the list of compatible software applications list at www.microsoft.com/windows2000/upgrade/compat. If an application is not on the list, it might still work with Windows 2000. You can verify that by checking with the application manufacturer's web site or technical support, or you can just install the application under Windows 2000 and test it yourself.

A⁺ OS 2.4 To take full advantage of Windows 2000 power management abilities, your system BIOS must be ACPI-compliant. Some BIOS manufacturers offer a BIOS upgrade to make older systems compliant. Most system BIOS made after January, 1999 are compliant. To learn if your BIOS is compliant, if you are upgrading from Windows 98 to Windows 2000, you can check for the ACPI feature under the Windows 98 Device Manager. Look for ACPI, Advanced Configuration and Power Management Interface in the Device Manager list of devices. Because Windows 95 and Windows NT do not support ACPI, it is not listed under these OS installations. You can also check the web site of the BIOS manufacturer or the Microsoft web site.

Microsoft calls a BIOS that is ACPI-compliant a good BIOS and puts it on the Good BIOS list. The Microsoft site allows you to search for ACPI-compatible computers. When you search by model and manufacturer, the Microsoft web site tells you if the system is compatible with Windows 2000 and sometimes provides a link to the BIOS web site where you can download an upgrade to the BIOS. If you are upgrading BIOS, do that before you begin the Windows 2000 installation. If the system is not ACPI-compliant, you can still install Windows 2000 but you cannot use some of the power management features.

For Microsoft links to hardware, software, and BIOS compatibility checks, see this URL:

www.microsoft.com/windows2000/upgrade/compat/default.asp

Also plan which partition on the hard drive will hold Windows 2000 and what file system you will use on that partition. Windows 2000 supports the FAT16, FAT32, and NTFS file systems. For compatibility with Windows 98, use the FAT32 file system. For compatibility with DOS or Windows 95, use FAT16, and for the most security, use NTFS. If the hard drive is not yet partitioned or formatted, Windows 2000 does that for you during the installation, or you can use FDISK to create partitions before you begin the installation.

Installing Windows 2000 on Networked Computers

If you are installing Windows 2000 on a network PC, consider where the Windows 2000 installation files are stored. You can install the OS from a CD in the computer's CD-ROM drive or you can store the files on a file server on the network and perform the installation from the file server. If you will be doing multiple installations on the network, consider using a file server. Copy all the files from the \i386 folder on the Windows 2000 CD to a folder on the file server and then share that folder on the network. Later, during the installation, when you are ready for the CD, point the setup program to the file server folder instead.

Windows 2000 offers a number of options for installation that can be automated without requiring someone to sit at the computer responding to the questions that setup asks during the installation process. One method is called an **unattended installation** and is performed by storing the answers to installation questions in a text file or script that Windows 2000 calls an **answer file**. A sample answer file is stored on the Windows 2000 CD. If you must perform many installations on computers that have the same Windows 2000 setup, it might be worth your time to develop an answer file to perform unattended installations. How to set up unattended installations is beyond the scope of this chapter.

When installing Windows 2000 on a network, just as with other operating systems, you need to know how to configure the computer to access the network. You should know these things before you begin the installation:

- The computer name and workgroup name for a peer-to-peer network
- The user name, user password, and host name for a domain network
- For TCP/IP networks, how the IP address is assigned, either dynamically (gets its IP address from a server when it first connects to the network) or statically (IP address is permanently assigned to the workstation). If the IP addresses are statically assigned, then have the IP address to assign the workstation.

Upgrade or Clean Install

If you are installing Windows 2000 on a new hard drive, then you are doing a clean install, but if Windows 9x or Windows NT is already installed on the hard drive, then you have three choices. You can perform a clean install, overwriting the existing operating system and applications; you can install Windows 2000 in a second partition on the hard drive and create a dual-boot situation; or you can perform an upgrade installation. There are advantages and disadvantages to each. If you perform an upgrade, you must begin the installation while you are in the current OS. Therefore, if you are working from a remote location on the network, you cannot do an upgrade.

Clean Install, Erasing Existing Installations If the hard drive does not have a lot of important data on it or if the data can be backed up, a clean install overwriting the existing installation has some advantages. One advantage is that you get a fresh start. With an upgrade, problems with applications or the OS might follow you into the Windows 2000 load. If you erase everything (format the hard drive), then you are assured that the registry as well as all applications are as clean as possible. The disadvantage is that, after Windows 2000 is installed, you must reinstall applications software on the hard drive and restore the data from backups. If you do a clean install, you can choose to format the hard drive first or simply do a clean install on top of the existing installation. If you don't format the drive, the data will still be on the drive, but the previous operating system settings and applications installations will be lost.

If you decide to do a clean install, verify that you have all the applications software CDs or floppy disks and software documentation. Back up all the data and verify that the backups are good. Then, and only then, format the hard drive or begin the clean install without formatting the drive.

Upgrade the Existing Operating System The advantages of upgrading are that all applications and data are carried forward into the new Windows 2000 environment, most OS settings carry forward, and the installation is faster.

Create a Dual Boot Don't create a dual boot unless you need two operating systems. Windows 2000 does not support a second operating system on the same partition, so you must use at least two partitions on the hard drive. All applications must be installed on each partition to be used by each OS.

A+ OS 1.3 You must decide what file system to use for the Windows 2000 partition: FAT16, FAT32, or NTFS. If you choose to use a dual boot with DOS, use FAT16 for the Windows 2000

A⁺ OS 1.3 partition so that DOS can read the partition. For Windows 9x, use either the FAT16 or FAT32 file system, not NTFS, so that Windows 9x can read the Windows 2000 partition.

Windows 2000 uses the latest version of NTFS that was first introduced by Windows NT Server 4.0, NTFS Version 5.0 (NTFS5). NTFS4 is used by Windows NT Workstation 4.0. The NTFS5 version includes numerous enhancements over previous versions, but cannot be read by Windows NT Workstation 4.0 unless Windows NT 4.0 Service Pack 4 is applied. For this reason, if you create a dual boot between Windows 2000 and Windows NT using NTFS for both operating systems, the file system data structures might not be the same, disk utilities such as Chkdsk under Windows NT might not work on the drive, and encrypted files and folders cannot be read by Windows NT. For this reason, using a dual boot between Windows 2000 and Windows NT is not recommended.

We first look at how to do a clean install, and then at how to do an upgrade.

Step-by-Step Instructions for a Clean Installation

The Windows 2000 package comes with documentation and a CD. For United States distributions, the package includes a floppy disk to provide 128-bit data encryption. (This disk is not included in distributions to foreign countries because of laws that prohibit 128-bit data encryption software from leaving the United States.)

If your PC is capable of booting from a CD, then insert the CD and turn on the PC. The Welcome to the Windows 2000 Setup Wizard screen appears. See Figure 14-11. Select **Install a new copy of Windows 2000**, and then click **Next** and proceed to Step 6 below. However, if your PC does not boot from a CD and you have a clean, empty hard drive, then first create a set of Windows 2000 setup disks to boot the PC and to begin the installation process. The remaining installation will be done from the CD.



Figure 14-11 Using the Setup Wizard, you can do an upgrade, do a clean install, or create a dual boot

A⁺ OS 2.2, 2.3 To make the four setup disks, follow these directions:

1. Format four floppy disks.
2. Using a working PC, place the Windows 2000 CD in the CD-ROM drive and a formatted floppy disk in the floppy disk drive. For Windows 9x, click **Start, Run** and enter this command in the Run dialog box:

D:\bootdisk\makeboot.exe A:

(Substitute the drive letter of the CD-ROM drive for D: and the letter of the floppy drive for A: in the command line.)

3. Insert new disks in the drive as requested. Label the disks Windows 2000 Setup Disks 1, 2, 3, and 4.

A⁺ OS 2.1, 2.2, 2.3

4. Now begin the Windows 2000 installation. Boot the PC from the first setup disk created above. You will be asked to insert each of the four disks in turn and then asked for the Windows 2000 CD.
5. The Windows 2000 license agreement appears. Accept the agreement and then the Welcome screen appears, shown in Figure 14-11. The setup process is now identical to that of booting directly from the CD. Save the four setup floppy disks in case you have future problems with Windows 2000.
6. Windows 2000 searches the hard drive for partitions and asks which partition to use. If the partitions are not created, it creates them for you. You are asked to decide which file system to use. If the hard drive has already been formatted with the FAT16 or FAT32 file system, you are asked if you want to upgrade to the NTFS file system. Be aware that if you convert the file system to NTFS, you cannot revert to FAT16 or FAT32. You can also convert from FAT16 or FAT32 to NTFS after the installation is complete. If the hard drive is already partitioned and contains a partition larger than 2 GB and if you select the FAT file system, then Windows 2000 automatically formats the drive using the FAT32 file system. It puts the entire partition into one logical FAT32 drive.
7. During the installation, you are given the opportunity to change your keyboard settings for different languages, enter your name and company name, and enter the product key found on the CD case. You are also given the opportunity to enter date and time settings and an Administrator password. Be sure to remember the password. If you forget it, the only recourse may be to reinstall Windows 2000.
8. If setup recognizes that you are connected to a network, it provides the Networking Settings window to configure the computer to access the network. If you select Typical settings, then setup automatically configures the OS for your network. After the installation, if the configuration is not correct, you can make changes.
9. At this point in the installation, you are asked to remove the Windows 2000 CD and click **Finish**. The computer then restarts. After Windows 2000 loads, it completes the process of connecting to the network. You are asked questions about the type of network (for example, does the network use a domain or workgroup?). When the configuration is complete, verify that you have access to the network if there is one.

A⁺ OS 2.1, 2.2, 2.3 Clean Install When the Hard Drive Has an Operating System Installed

Using Windows 9x, if your PC automatically detects a CD in the CD-ROM drive, follow these directions to do a clean install when another OS is already installed:

1. Insert the Windows 2000 CD in the CD-ROM drive. If your PC detects the CD, a window opens with the message “This CD-ROM contains a newer version of Windows that the one you are presently using. Would you like to upgrade to Windows 2000?” Answer **No**. The Install Windows 2000 window appears (see Figure 14-12).
2. Click **Install Windows 2000**. The Windows Setup Wizard opens, as in Figure 14-11. Select **Install a new copy of Windows 2000 (Clean Install)**. You will be asked to accept the license agreement, which is displayed, enter the product key from the back of the CD case, and given the opportunity to select special options. After a reboot, the installation process continues as described above.

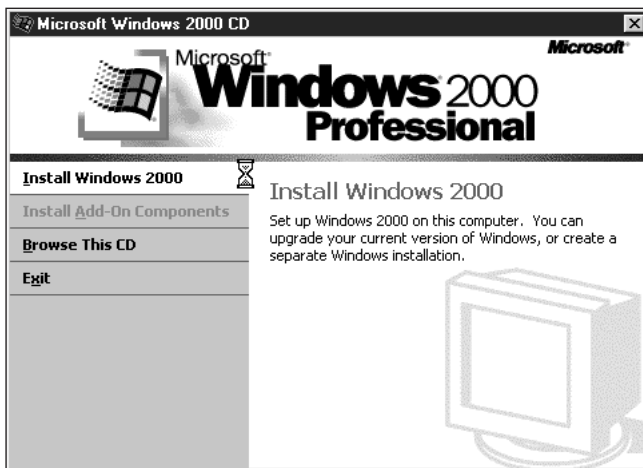


Figure 14-12 Windows 2000 setup window

A⁺ OS 2.2, 2.1 If your PC does not automatically recognize a CD, then insert the CD in the CD-ROM drive and do the following:

1. Click **Start, Run**. In the Run dialog box, enter the command:
D:\i386\winnt32.exe. Substitute the drive letter of the CD-ROM drive for D:.
2. The Windows 2000 Setup Wizard appears, as in Figure 14-11. Select **Install a new copy of Windows 2000 (Clean Install)**. The installation process continues as described above.

Step-by-Step Instructions for an Upgrade Installation

Recall that devices, device drivers, and applications must all be Windows 2000-compatible for a successful installation. When you are checking applications and devices for compatibility, you might be provided with a fix from the hardware or software manufacturer in order to achieve compatibility. During the upgrade, if Windows 2000 Setup detects a problem, it gives you the opportunity to provide the files for the fix.

To upgrade your operating system from Windows 9x or Windows NT using the Windows 2000 CD, first prepare for the installation by doing the following:

1. Verify that all devices and applications are Windows 2000-compatible.
2. Verify that you have at least 650 MB of free space on your hard drive. (Recall that you also must have at least 64 MB of RAM and a 133 MHz Pentium-compatible CPU.)
3. Using antivirus software, scan memory and your hard drive for viruses.
4. Back up all critical system files and data files. Back up the registry in case you need to backtrack to the current installation. If you have important data on your hard drive, back up the data.
5. Close all applications and disable any virus-scanning software. If the hard drive is compressed, decompress the drive.

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You are now ready to perform the upgrade. Do the following:

1. Insert the Windows 2000 CD in the CD-ROM drive. If your system is set to automatically detect the CD, it runs the setup program and shows a message asking if you want to upgrade your computer to Windows 2000. Answer **Yes**, and the installation process begins. If Windows does not detect the CD, then click **Start, Run**, enter **D:\i386\winnt32.exe** in the Run dialog box, and click **OK**. Substitute the drive letter of the CD-ROM drive for D:. On the Welcome to Windows 2000 Setup Wizard Screen, select **Upgrade to Windows 2000 (Recommended)**. Follow the directions on the screen.
2. Windows 2000 Setup performs the upgrade in two major stages: the Report phase and the Setup phase. During the Report phase, Windows 2000 Setup scans the hardware, device drivers, current operating system, and applications for compatibility. Also, in the Report phase, you are given the opportunity to provide third-party DLL files that make a device driver or application Windows 2000-compatible, if Setup recognizes that the device driver or application will not work without the fix. Next, Setup generates a report of its findings. If findings indicate that an unsuccessful installation is likely to happen, you can abandon the installation and perhaps check with hardware and software manufacturers for fixes. In the Report phase, Setup also creates an answer file that it will use during the Setup phase, installs the Windows 2000 boot loader, and copies Windows 2000 installation files to the hard drive.
3. The PC reboots and the Setup phase begins, which has two parts: the Text mode and the GUI mode. In the Text mode, Setup installs a Windows 2000 base in the same folder that the old OS is in, usually C:\Windows for Windows 9x and

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C:\WINNT for Windows NT. This target folder cannot be changed at this point. Setup then moves the Windows registry and profile information to %windir%\setup\temp, which most likely is C:\Windows\setup\temp.

4. The PC reboots again, and the GUI mode of Setup begins. Setup reads information that it saved about the old Windows system and makes appropriate changes to the Windows 2000 registry. It then migrates application DLLs to Windows 2000 and reboots for the last time. The upgrade is now done.

TROUBLESHOOTING PROBLEMS WITH WINDOWS 2000

As with other operating systems, problems can be grouped as those that prevent the operating system from loading properly and those that occur after loading. This section looks at both categories, beginning with problems loading Windows 2000. But first, as you know, the best way to solve a problem is to be prepared before the problem occurs. No problem-solving tool is better than a good backup of critical system files, so we first look at Windows 2000 provisions for backing up critical system files.

Backing Up the System State

Windows 2000 calls the files critical to a successful operating system load the **System State data**. This includes all files necessary to boot the OS, the Windows 2000 registry, and all system files in the %SystemRoot% folder (the folder in which Windows 2000 is installed, most likely C:\WINNT). When you perform a backup of the System State data, you cannot select which of these files you want to back up because Windows 2000 will always back up all of them. Here is the process:

1. Click **Start**, point to **Programs**, **Accessories**, and **System Tools** and then click **Backup**. The Backup dialog box opens. Click the **Backup** tab. See Figure 14-13.

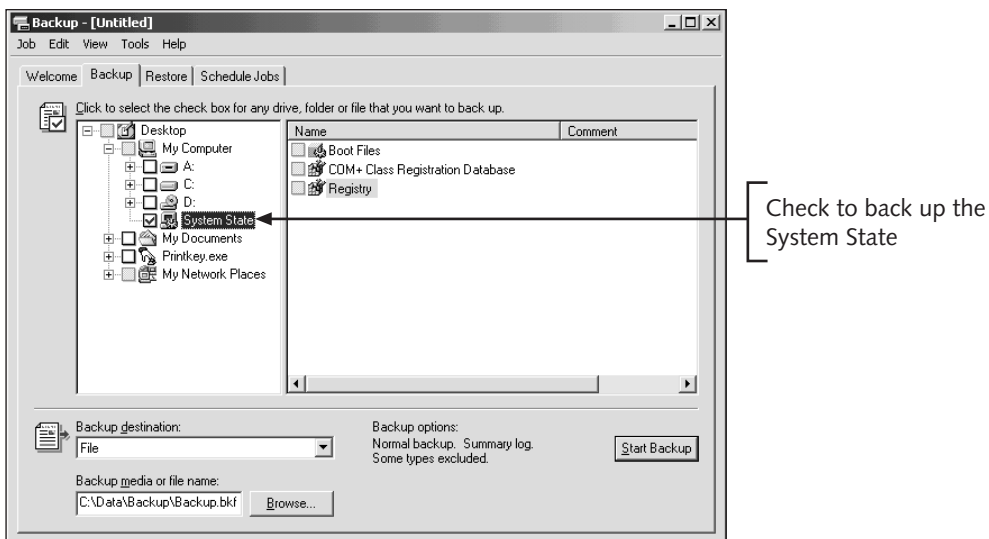


Figure 14-13 Back up the Windows 2000 Registry and all critical system files

2. Check the **System State** box in the list of items you can back up. Notice in Figure 14-13 that the System State includes the boot files and the registry. It also includes the COM+ (Component Object Model) Registration Database, which contains information about applications and includes files in the Windows folders.
3. Select the destination for the backup. You can back up to any media, including a folder on the hard drive, Zip drives, tape drives, or a network drive. Click **Start Backup** to begin the process.

Later, if you have problems with a corrupted Windows 2000 installation, you can click the Restore tab in the Backup window illustrated in Figure 14-13 to restore the system to its state at the last backup.

When you back up the System State, the registry is also backed up to the folder %SystemRoot%\repair\RegBack. If you later have a corrupted registry, you can copy files from this folder to the registry folder, which is %SystemRoot%\System32\Config. You will learn more about this later in the chapter.

We now turn our attention to understanding the boot process and the tools offered by Windows 2000 to solve problems when booting the OS.

Understanding the Boot Process

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The Windows 2000 boot process proceeds just as does the Windows NT process. You can review these steps in Chapter 13. In this section, we look at some of the troubleshooting tools provided by Windows 2000 to solve boot problems.

Just as with Windows NT, Windows 2000 can be installed in two partitions, the system partition and the boot partition. The system partition is the active partition and contains the files necessary to boot Windows 2000 in the root directory. The boot partition contains the main Windows 2000 directory and usually contains the page file, which is used as virtual memory. For personal computers, most likely all files are contained in a single partition, which is both the system and boot partition. This is the case in Figure 14-14, which shows the files in the root directory.

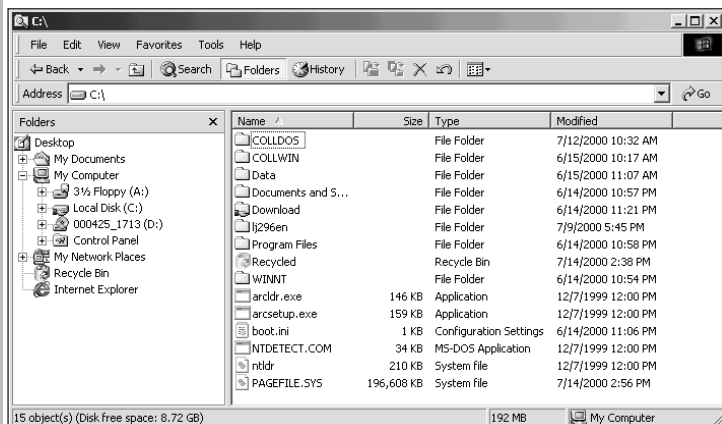


Figure 14-14 Files in the root directory of a Windows 2000 system

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The steps to booting are:

1. System BIOS performs POST and then turns to the MBR on the hard drive for an OS.
2. The MBR looks to the bootstrap loader program in the boot sector of the active partition. The bootstrap loader program executes ntldr, the Windows 2000 boot loader program.
3. Ntldr reads Boot.ini and provides a boot loader menu for a dual booting system, if so indicated by the entries in Boot.ini.
4. Ntldr executes NTDetect.com to detect and configure the hardware present, reads information from the registry about device drivers, and loads them.
5. Ntldr loads the Windows 2000 kernel, including the Hal.dll and Ntoskrnl.exe files, and passes control to Ntoskrnl.exe, the kernel-controlling module.

Troubleshooting the Boot Process

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When problems arise with booting, as with all PC problems, try the simple things first. Turn off the power and restart. Check for loose cables, switches not on, stuck keys on the keyboard, a wall outlet switch turned off, and similar easy-to-solve problems. The next step is to determine at what point in the boot process the system fails. Ask what has happened since the last successful boot. Has new hardware or software been installed? Has there been a power surge or electrical storm? Has an inexperienced user tinkered with the system? If you cannot pinpoint the source of the problem, then you have several tools to help you troubleshoot the boot process. Windows 2000 offers an Advanced Options Menu, which includes starting the computer in Safe Mode. Use this option to prevent many device drivers and system services that normally load during the boot process from loading. You can then correct or disable these devices or services once the OS loads. The second utility, called the Recovery Console, is new to Windows 2000. It provides a command-line interface for you to perform maintenance and repairs to the hard drive. Another tool is the Emergency Startup Disk, which is used to recover from problems with corrupted or missing operating system files or a corrupted hard drive boot sector. These three tools are discussed next.

Advanced Options Menu

As a PC boots, when the message, Starting Windows, appears at the bottom of the screen, press the F8 key to display the Windows 2000 **Advanced Options Menu** shown in Figure 14-15. As with the Windows 9x Startup Menu, this menu can be used to diagnose and fix problems when booting Windows 2000. Here is the purpose of each option on the menu:

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Windows 2000 Advanced Options Menu
Please select an option:

Safe Mode
Safe Mode with Networking
Safe Mode with Command Prompt

Enable Boot Logging
Enable VGA Mode
Last Known Good Configuration
Directory Services Restore Mode (Windows 2000 domain controllers only)
Debugging Mode

Boot Normally

Use ↑ and ↓ to move the highlight to your choice.
Press Enter to choose.

Figure 14-15 Press the F8 key at startup to display the Windows 2000 Advanced Options Menu

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Safe Mode Safe Mode boots the OS with a minimum configuration and can be used to solve problems when a new hardware installation is causing problems. Safe Mode boots with the mouse, monitor with basic video, keyboard, and mass storage drivers loaded. It uses the default system services (it does not load any extra services) and does not provide access to a network. When you boot in Safe Mode, you see “Safe Mode” in all four corners of your screen. You have a GUI interface in Safe Mode. Once the OS loads in Safe Mode, you can disable the problem device, scan for viruses, run diagnostic software, or take other appropriate action to diagnose and solve problems. When you load Windows 2000 in Safe Mode, all files used for the load are recorded in the Ntbtlog.txt file.

Safe Mode with Networking Use this option when you are solving a problem with booting and need access to the network to solve the problem. For example, if you have just attempted to install a printer which is causing the OS to hang when it boots and the printer drivers are downloaded from the network, boot into Safe Mode with Networking. Uninstall the printer and then install it again from the network. Also use this mode when the Windows 2000 installation files are not loaded from CD, but from the network, and you need to access these files.

Safe Mode with Command Prompt This Safe Mode option does not automatically load a GUI desktop. Use it to get a command prompt. If Safe Mode does not load the OS, then try this option.

Enable Boot Logging When you boot with this option, Windows 2000 loads normally and you access the regular desktop as usual. However, all the files used during the load process are recorded in a file, Ntbtlog.txt. Use this option to see what did and did not load during the boot process. If you are having a problem getting a device to work, check the file for its driver files. Boot logging is much more effective if you have a copy of the file that was made when everything was working as it should, and then you can compare the good load to the bad load, looking for the differences.

Enable VGA Mode Use this option when the video setting is such that you can't see well enough to fix a bad setting. This can happen because of a corrupted video driver or when a user has created a desktop with black fonts on a black background, or something similar. Booting in this mode gives you a very plain VGA video. Go to the Display settings, correct the problem, and reboot normally.

Last Known Good Configuration Just as with Windows NT, Windows 2000 keeps the Last Known Good Configuration in the registry. Use this option if you suspect the system was configured incorrectly. Windows 2000 will be restored to the settings of the last successful boot and all system setting changes made after this last successful boot are lost.

Directory Services Restore Mode (Windows 2000 Domain Controllers Only) This option only applies to domain controllers and is used as one step in the process of recovering from a corrupted Active Directory domain database. The details of how all this works are beyond the scope of this chapter.

Debugging Mode This mode gives you the opportunity to move system boot logs from the failing computer to another computer for evaluation. Connect a computer to this computer by way of the serial port. In this mode, Windows 2000 sends all the boot information to the serial port. The details of how to do this can be found in the Windows 2000 Professional Resource Kit by Microsoft.

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Recovery Console

The Advanced Options menu can help if the problem is with a faulty device driver or system service. However, if the problem goes deeper than that, the next tool to use is the **Recovery Console**. Use it when the operating system does not start properly or hangs during the load. The Recovery Console does not use a GUI, and with it you can access the FAT16, FAT32, and NTFS file systems.

The purpose of the Recovery Console is to allow you to use tools to repair a damaged registry, system files, and file system on the hard drive. You must enter the Administrator password in order to use the Console. If the registry is so corrupted that the Recovery Console cannot read the password in order to validate it, you are not asked for the password but you are limited in what you can do at the Console. You are not allowed into all folders, and you cannot copy files from the hard drive to a floppy disk without setting certain parameters.

The Recovery Console software is on the Windows 2000 CD and also on the four Windows 2000 setup disks. If you have not already created the setup disks, you can go to a working Windows 2000 PC and create the disks by following the directions given earlier in the chapter. Follow these steps to load Windows 2000 from the disks and access the Recovery Console:

1. Insert the first of the four setup disks and restart the PC. You are directed to insert each of the four disks in turn, and then the Setup screen appears as shown in Figure 14-16.

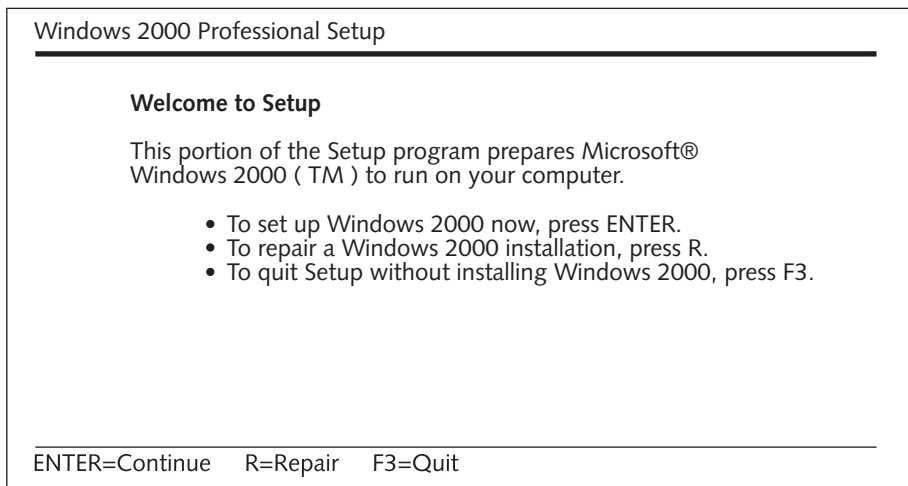


Figure 14-16 Use this Windows Setup screen to access the Recovery Console

2. Type **R** to select the To repair a Windows 2000 installation option. The Windows 2000 Repair Options window opens. See Figure 14-17. Type **C** to select the Recovery Console.

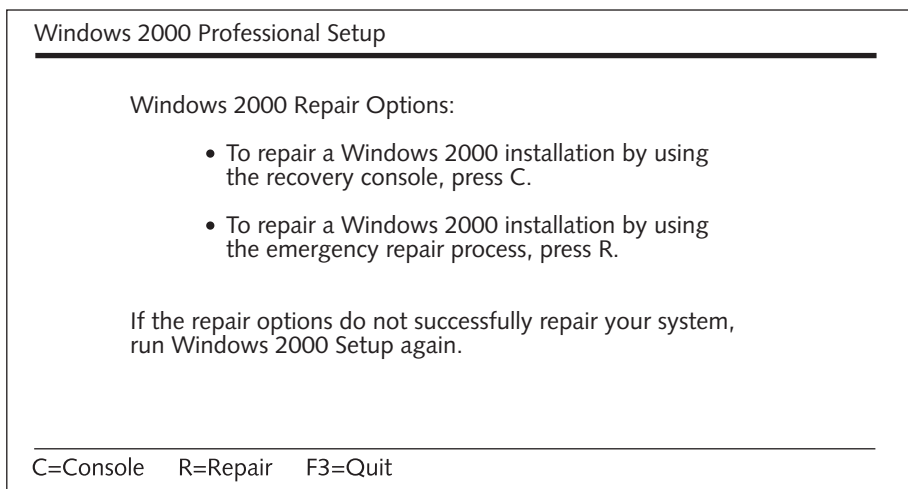


Figure 14-17 Windows 2000 offers two repair options

3. The Windows 2000 Recovery Console window opens. See Figure 14-18. The Recovery Console looked at the hard drive and determined that there was only a single Windows 2000 installation on the drive installed in the C:\WINNT folder. (The WINNT folder might be on a different drive on your machine.) Press **1** and press **Enter** to select that installation.


```
Microsoft Windows 2000 ( TM ) Recovery Console.

The Recovery Console provides system repair and recovery functionality.

Type EXIT to quit the Recovery Console and restart the computer.


1: C:\WINNT

Which Windows 2000 installation would you like to log onto
(To cancel, press ENTER)? 1
Type the Administrator password:
C:\WINNT>
```

Figure 14-18 The Windows 2000 Recovery Console command prompt

4. Enter the Administrator password and press **Enter**. If you don't know the password, you cannot use the console.

You now have a command prompt. You can use a limited group of DOS-like commands at this point to recover a failed system. These commands are listed and described in Table 14-2.



At the command prompt, to retrieve the last command entered, press the F1 key to retrieve one character at a time.

Table 14-2 Commands available from the Recovery Console

Command	Description
Attrib	Changes the attributes of a file or folder (works the same as the DOS version, as in the following example): <code>Attrib -r -h -s filename</code> This command removes the read, hidden, and system attributes from the file.
Batch	Carries out commands stored in a batch file: <code>Batch file1 file2</code> The commands stored in file1 are executed and the results written to file2. If no file2 is specified, results are written to screen.
Cd	Displays or changes the current directory
Chkdsk	Checks a disk and repairs or recovers the data
Cls	Clears the screen
Copy	Copies a single file: <code>Copy File1 File2</code> You can include paths to either file. No wildcard characters are allowed.
Del	Deletes a file: <code>Del File1</code>
Dir	Lists files and folders
Disable	Disables a Windows 2000 system service or driver: <code>Disable servicename</code>
Diskpart	Creates and deletes partitions on the hard drive. Enter the command with no arguments to display a user interface.
Enable	Enables a Windows 2000 system service or driver: <code>Enable servicename</code>

Table 14-2 Commands available from the Recovery Console (continued)

Command	Description
Exit	Quits the Recovery Console and restarts the computer
Expand	Expands a compressed file. For example: <code>Expand file1</code>
Fixboot	Rewrites the OS boot sector on the hard drive. If a drive letter is not specified, the system drive is assumed. <code>Fixboot C:</code>
Fixmbr	Rewrites the master boot record boot program. This command is the same as FDISK/MBR.
Format	Formats a logical drive. If no file system is specified, NTFS is assumed: <code>Format C:/fs:FAT32</code> Uses FAT32 file system <code>Format C:/fs:FAT</code> Uses FAT16 file system
Help	Help utility appears for the given command: <code>Help Fixboot</code>
Listsvc	Lists all available services
Logon	Allows you to log on to an installation with the Administrator password
Map	Lists all drive letters and file system types
Md or Mkdir	Creates a directory: <code>MD C:\TEMP</code>
More or Type	Displays a text file on screen: <code>TYPE filename.ext</code>
Rd or Rmdir	Deletes a directory: <code>RD C:\TEMP</code>
Rename or Ren	Renames a file: <code>Rename File1.txt File2.txt</code>
Set	Displays or sets Recovery Console environmental variables
Systemroot	Sets the current directory to the directory where Windows 2000 is installed

If you suspect that the registry is damaged, you can use these commands to restore the registry from the last backup that you have created in the %SystemRoot%\Repair\RegBack folder. To do so, first rename the registry files so that you can backtrack if necessary. From the Recovery Console command prompt, perform the steps outlined in Table 14-3. These actions will restore the registry to its state at the time of the last backup.

Table 14-3 Steps to restore the registry

Command	Description
1. Systemroot	Makes the Windows folder the current folder
2. CD System32\Config	Makes the Windows registry folder the current folder
3. Ren Default Default.save Ren Sam Sam.save Ren Security Security.save Ren Software Software.save Ren System System.save	Renames the five registry files
4. Systemroot	Returns to the Windows folder

Table 14-3 Steps to restore the registry (continued)

Command	Description
5. CD repair\RegBack	Makes the registry backup folder the current folder
6. Copy default C:\WINNT\system32\config Copy Sam C:\WINNT\system32\config Copy Security C:\WINNT\system32\config Copy Software C:\WINNT\system32\config Copy System C:\WINNT\system32\config	Copies the five registry files from the backup folder to the registry folder

To leave the Recovery Console and start Windows 2000, type **Exit** at the command prompt.

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Emergency Repair Process

If options on the Advanced Options menu fail to recover the system and the Recovery Console fails, your next option is the **Emergency Repair Process**. You only want to use this option as a last resort because it restores the system to the state it was in immediately after the Windows 2000 installation. All changes since the installation will be lost. The process uses an Emergency Repair Disk (ERD), but the disk does not contain the same information as does the Windows NT ERD (Windows NT Emergency Repair Disk).

Recall that the Windows NT ERD contains a copy of the registry and that you should update the disk any time you make significant changes to the registry. You can then use the disk to repair a corrupted registry, restoring it to its state when you last updated the ERD.

The Windows 2000 ERD contains information about your current installation, but does not contain a copy of the registry because it is too large to fit on a single floppy disk. Rather the ERD only points to a folder on the hard drive where the registry was backed up when Windows 2000 was installed. This folder is %SystemRoot%\repair, and its contents are shown in Figure 14-19.

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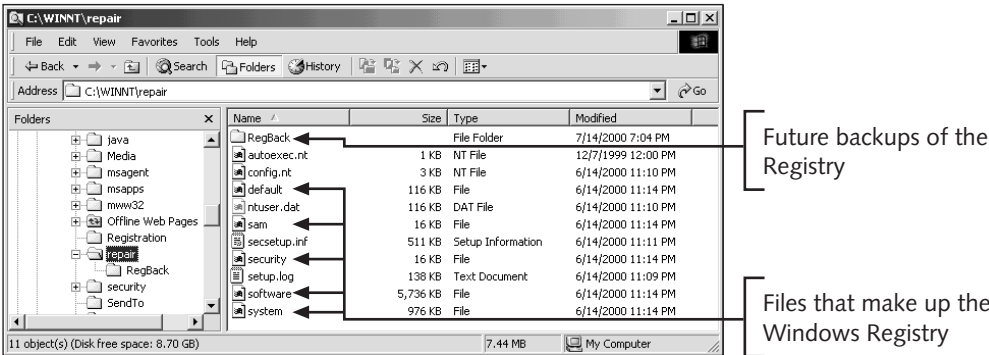


Figure 14-19 Windows 2000 backs up the registry and system data to %SystemRoot%\repair during the installation process

A⁺OS 2.3 Using the ERD to recover from a corrupted registry returns you to the installation version of the registry, and you lose all changes to the registry since that time. Because of the way the ERD works, you do not need to remake the disk once you've created it. Before a problem occurs, follow these directions to create the disk:

1. Click **Start**, point to **Programs**, **Accessories**, and **System Tools**, and then click **Backup**. The Backup window appears with the Welcome tab selected. See Figure 14-20. Select **Emergency Repair Disk**.
2. The Backup tab and the Emergency Repair Diskette dialog box open. See Figure 14-21. If you check the box shown in Figure 14-21, the system backs up your registry to a folder under the Repair folder, %SystemRoot%\repair\RegBack (refer back to Figure 14-19).
3. Click **OK** to create the disk. Label the disk Windows 2000 Emergency Repair Disk, and keep it in a safe place.

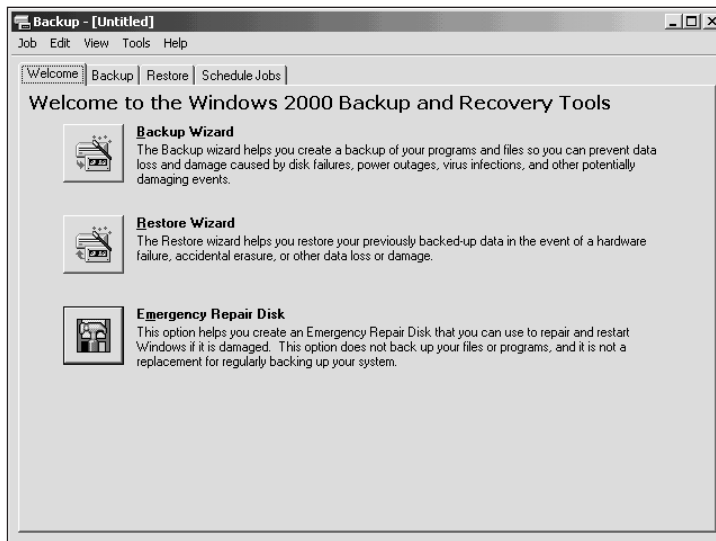


Figure 14-20 Use the Backup window to back up the registry and create an Emergency Repair Disk

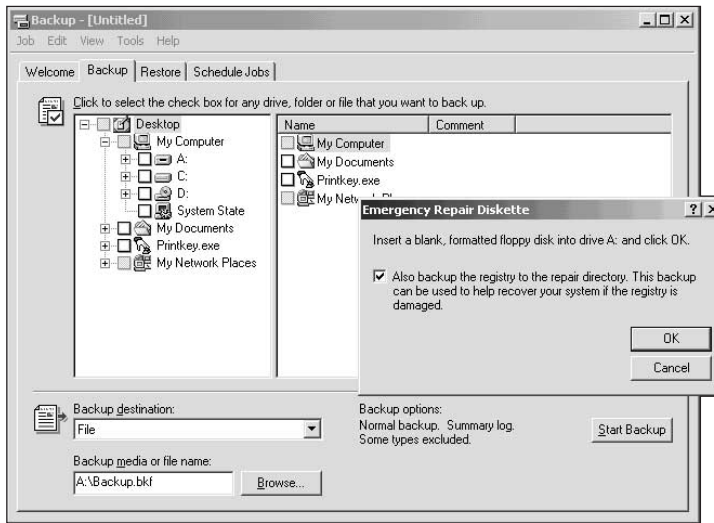


Figure 14-21 Create an ERD and back up the registry to the hard drive

If your hard drive fails, you can use the disk to restore the system, including system files, boot files, and the registry, to its state at the end of the Windows 2000 installation. To do that follow these steps:

1. Boot the PC from the four Windows 2000 setup disks. The Setup menu appears (refer back to Figure 14-16). Select option **R**.
2. When the Windows 2000 Repair Options window opens (refer back to Figure 14-17), select option **R**.
3. You are instructed to insert the Emergency Repair Disk. Follow the instructions on the screen to repair the installation.

If this process does not work, then your next option is to reinstall Windows 2000. Be sure to use ScanDisk to scan the drive surface for errors before you do the installation. If you suspect that a virus has damaged the hard drive file system, also use the FDISK/MBR command discussed in earlier chapters to replace the master boot program in case it has been corrupted by the virus. Windows 2000 also offers a utility called InoculateIT Antivirus AVBoot, which is a command-line tool that can scan memory, the MBR sector, and OS boot sectors for viruses. You will learn to use the utility in a project at the end of the chapter.

Problems After the Operating System Loads

Windows 2000 offers several maintenance tools that can help prevent and solve problems after the system loads. Some are similar to Windows 9x, Windows NT, and DOS tools, and some are new to Windows 2000. Several are discussed next.

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Chkdsk Chkdsk is located in the %SystemRoot%\System32 folder. It scans a floppy disk or hard drive for lost clusters and cross-linked files and repairs them if you have included the /F option in the command line. Enter this command in the Run dialog box: **C:\WINNT\system32\chkdsk.exe / F**

Substitute the drive and folder name where Windows 2000 is installed, in the command line.

A⁺OS 1.1 **CMD** Executing **CMD.exe** from the Run dialog box opens a command interpreter window where you can use DOS-like commands at a command prompt. A command window is also available under Start, Programs, Accessories, Command Prompt. Type **Exit** to close the window. You can also execute single commands from the Run dialog box without having to open the command window. Use the CMD command with the /C option like this: CMD /C CHKDSK

A⁺OS 1.2 **Compress** To save disk space, using the NTFS file system, you can compress an entire volume, individual files or folders. Using Windows Explorer, right-click on the volume, folder or file name and select **Properties** from the shortcut menu. Select the **General** tab and, for a file or folder, check **Compress contents to save disk space** and click **OK**. For a volume, check **Compress drive to save disk space** and click **OK**. Later, if you decide to not use compression, clear the checkbox.

A⁺OS 1.3, 3.2 Disk Defragmenter

To run Disk Defragmenter, click **Start**, point to **Programs**, **Accessories**, and **System Tools**, and then click **Disk Defragmenter**. Just as with Windows 98, this tool reorganizes files on the hard drive to eliminate fragmented files and gives you a nice graphical view of the process as it works.

Another way to access Disk Defragmenter is from Explorer. Right-click a logical drive letter in Explorer and select **Properties** from the shortcut menu. The drive Properties window opens (see Figure 14-22). Select the **Tools** tab. From this window you can access the Windows 2000 Backup utility to back up folders on the drive, defragment the drive using Disk Defragmenter, and scan the drive for errors using ScanDisk.

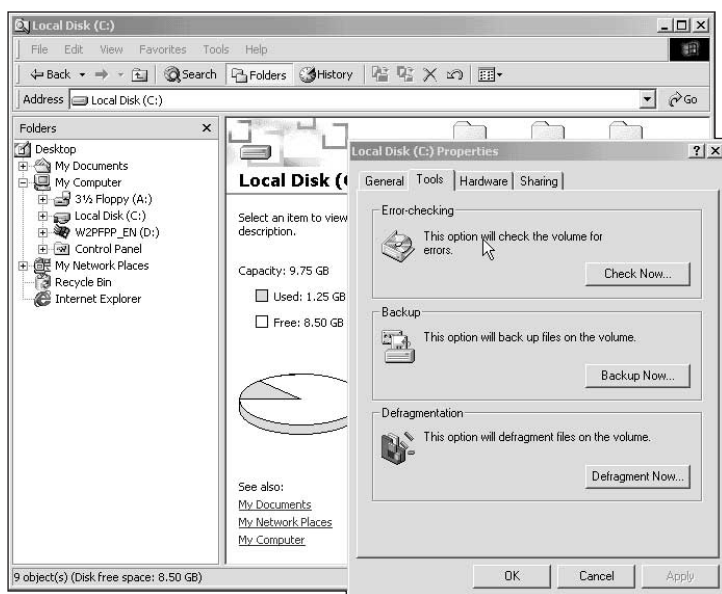


Figure 14-22 The Tools tab of a local disk Properties dialog box has tools to back up and manage the hard drive

Windows Update

You can quickly download service packs (fixes to known Windows 2000 bugs) from the windowsupdate.microsoft.com web site by clicking **Start, Windows Update** (see Figure 14-23). Internet Explorer opens and displays the web site. Download the latest service pack, which downloads the file to a directory on your hard drive. If you think you might later want to uninstall the fix, when given the opportunity, select the **Save uninstall information** option.

Later, to uninstall the fix, again execute the downloaded file. When given the option, select **Uninstall a previously installed service pack**.

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System File Checker

System File Checker is part of the new Windows 2000 utility that protects system files, called **Windows File Protection (WFP)**. WFP runs in the background and alerts a user when a system file has been altered. The message you see is:

A file replacement was attempted on the protected system file <filename>. To maintain system stability, the file has been restored to the correct Microsoft version. If problems occur with your application, please contact the application vendor for support.

If you see this message, carefully note what application was working at the time and what had just happened before the message. Suspect a virus or bad application software.

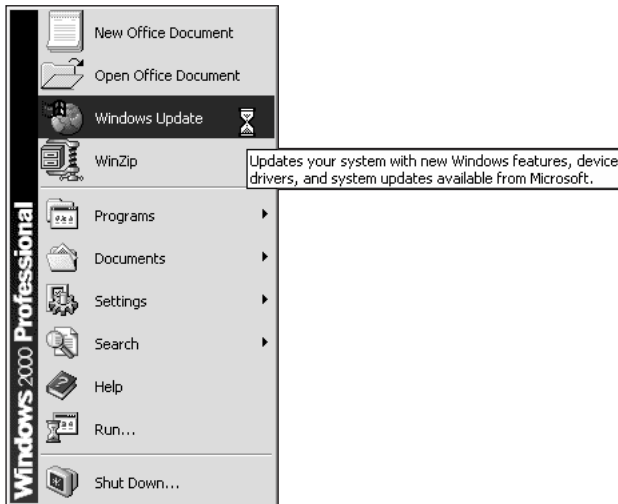


Figure 14-23 Windows Update accesses the web site windowsupdate.microsoft.com

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If you suspect that system files have become corrupted or deleted, use System File Checker. Click **Start, Run**, and enter this command in the Run dialog box: **C:\WINNT\system32\sfc.exe /scannow**. If the utility cannot retrieve a copy of a corrupted system file from its cache, it requests that you insert the Windows 2000 CD in the CD-ROM drive.

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1.1

Computer Management

Computer Management is a window that consolidates several tools that you can use to manage the local PC or other computers on the network. It combines several Windows 2000 administrative tools. To access Computer Management, click **Start**, point to **Programs, Administrative Tools**, and then click **Computer Management**. The Computer Management window appears. See Figure 14-24. Some of the tasks you can perform from this window include monitoring problems with hardware, software, and security. You can share folders, view device configurations, add new device drivers, start and stop services, and manage server applications.

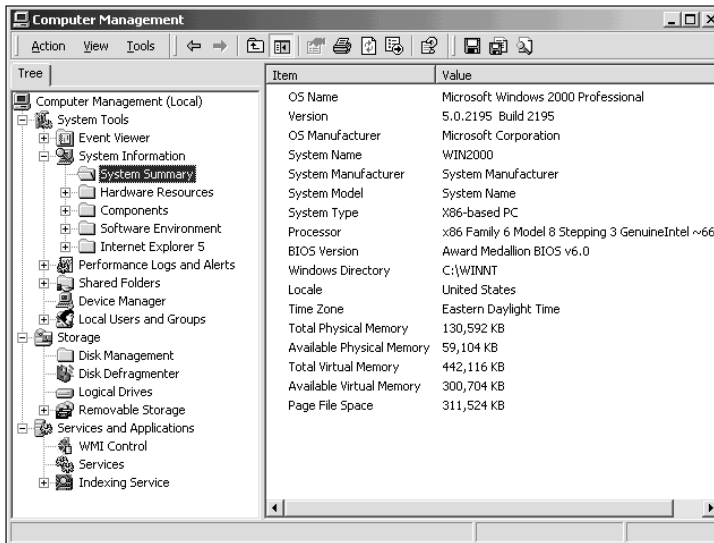


Figure 14-24 Computer Management combines several administrative tools into a single easy-to-access window

Microsoft Management Console

When Windows combines several administrative tools into a single window, the window is called a **console**. Individual tools within the console are called **snap-ins**. For example, Computer Management is a console, and Event Viewer and System Information are two snap-ins in that console. Another example of a console is Recovery Console, which contains a set of commands, or tools, you can use to recover from a failed Windows 2000 boot.

You can use Microsoft Management Console to create your own customized consoles. You can also save the console to a file, which is assigned a **.msc** file extension. Store the file in the *system-drive*\Documents and Settings\user\Start Menu\Programs\Administrative Tools folder to make it open as a program when you click **Start**, and point to **Programs, Administrative Tools**. In the path, substitute the drive letter of the system drive and the name of the user. For example, if the system drive is C and the user is Administrator, the path to the **.msc** file is C:\Documents and Settings\Administrator\Start Menu\Programs\Administrative Tools. Once you create a console, you can copy the **.msc** file to any computer or place a shortcut to it on the desktop. To create a shortcut, right click on the file name and select **Create Shortcut** and then drag the shortcut to the desktop. You can also use your right mouse button to drag the file to the desktop and then select **Create Shortcut Here** from the menu that appears when you drop the file on the desktop.

Follow these directions to create a console that contains some popular utility tools:

1. Click **Start, Run**, enter **MMC** in the Run dialog box and click **OK**. An empty console window appears as seen in Figure 14-25.
2. Click **Console** on the menu bar, and then click **Add/Remove Snap-in**. The Add/Remove Snap-in window opens. The window illustrated in Figure 14-26 is empty because no snap-ins have been added to the console.

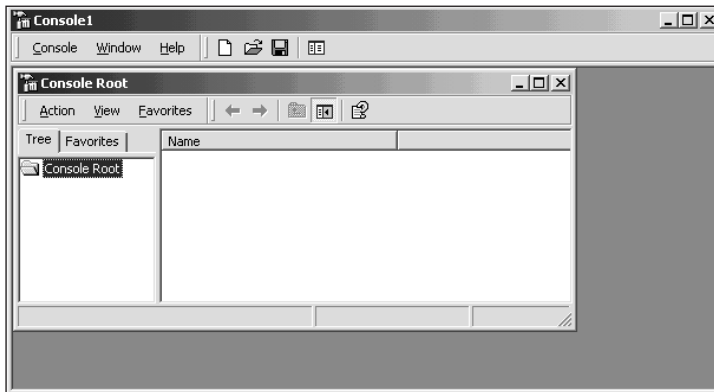


Figure 14-25 An empty console

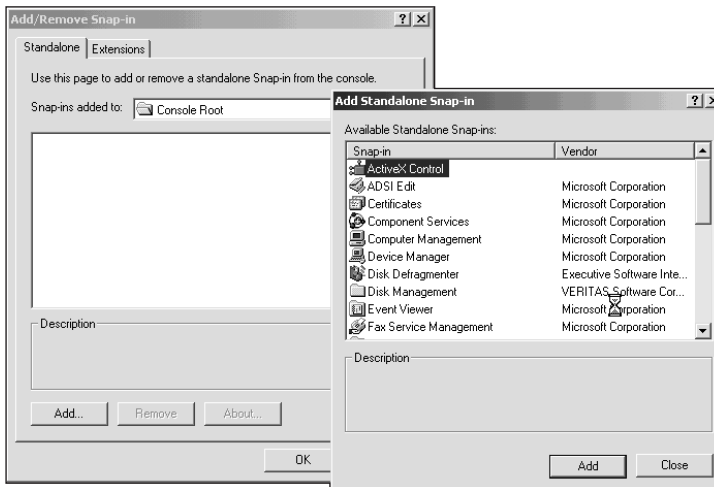


Figure 14-26 List of snap-ins available to be added to a console

3. Click **Add**. You see a list of snap-ins that can be added to a console, as shown in Figure 14-26. Select a snap-in and click **Add**.
4. A dialog box opens that allows you to set the parameters for the snap-in. The dialog box offers different selections depending on the snap-in being added. A sample dialog box is shown in Figure 14-27. When you have made your selections, click **Finish**. The new snap-in appears in the Add/Remove Snap-in window.

5. Repeat Steps 3 and 4 until you have added all the snap-ins that you want to the console. When you are finished, from the Add Standalone Snap-in window illustrated in Figure 14-26, click **Close** then click **OK**.
6. Figure 14-28 shows a console with four snap-ins added. To save the console, click **Console** on the menu bar, and then click **Save As**. The Save As dialog box opens.

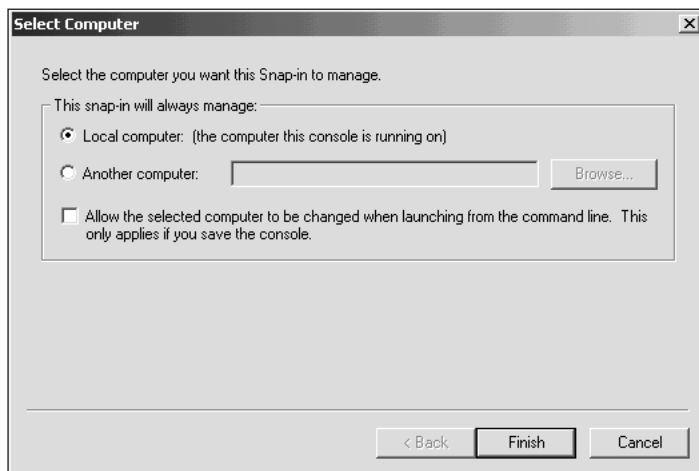


Figure 14-27 Set the parameters for the snap-in

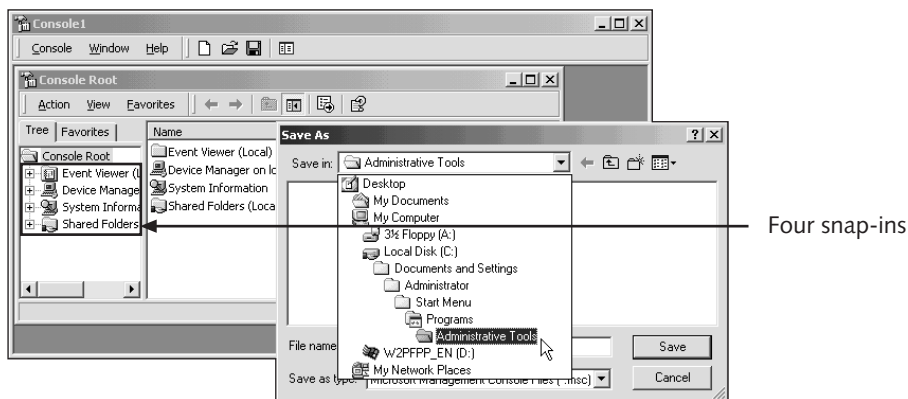


Figure 14-28 Saving a console with four snap-ins

7. The default location for the console file is shown in Figure 14-28—the location that ensures the console appears as an option under Administrative Tools on the Start menu. Select this location for the file, name the file, and click **Save**.
8. Close the console window by clicking **Console, Exit**.

In this example, the console file was named **My Console**. Figure 14-29 shows the console listed under **Start, Programs, Administrative Tools**.

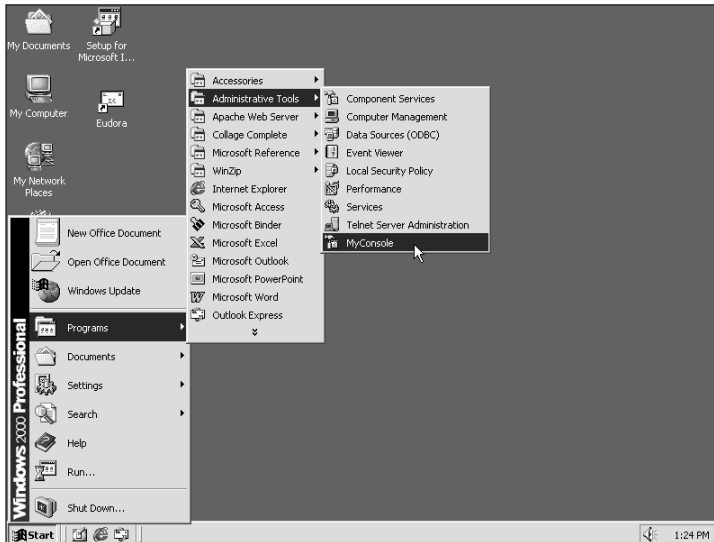


Figure 14-29 New console is listed under Administrative Tools

Windows 2000 Support Tools

A⁺OS 2.4 Windows 2000 offers several support tools that you can install. They are located in the \Support\Tools folder of the Windows 2000 CD. To install them, run the Setup program in that folder. Enter this command in the Run dialog box: **D:\Support\Tools\Setup.exe**. Substitute the drive letter of the CD-ROM drive in the command line. The list of tools installed is shown in Figure 14-30.

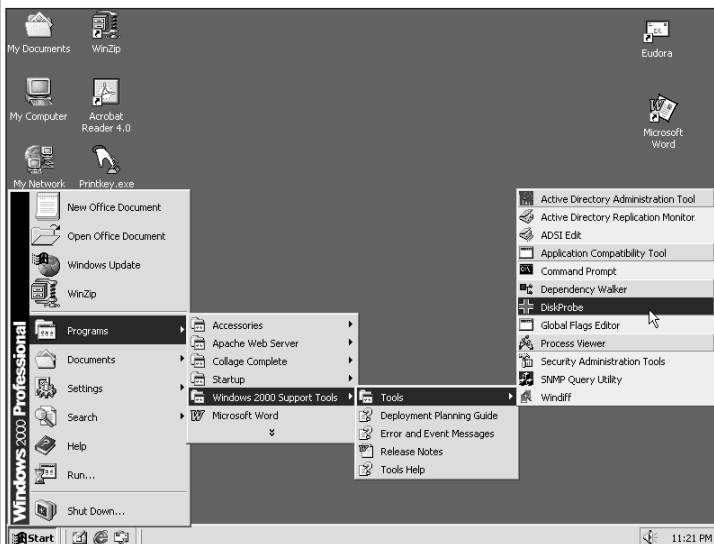


Figure 14-30 Windows 2000 support tools

A⁺_{2.4} One of these utilities is Dependency Walker, which lists all the files used by an application. It can be useful when troubleshooting a failed application installation if you have a report of files used by the application on a computer where the installation is good. Recall from Chapter 12 that software applications often use DLL files for added functionality and to relate to the operating system. To use the utility, click **Start**, point to **Programs, Windows 2000 Support Tools**, and then click **Dependency Walker**. Figure 14-31 shows the resulting Dependency Walker window. Click **File, Open**, and select the main executable file for an application. In the figure, Apache.exe is selected. Apache is a popular Web server application. The window lists all supporting files that Apache.exe uses and how they are dependent on one another.

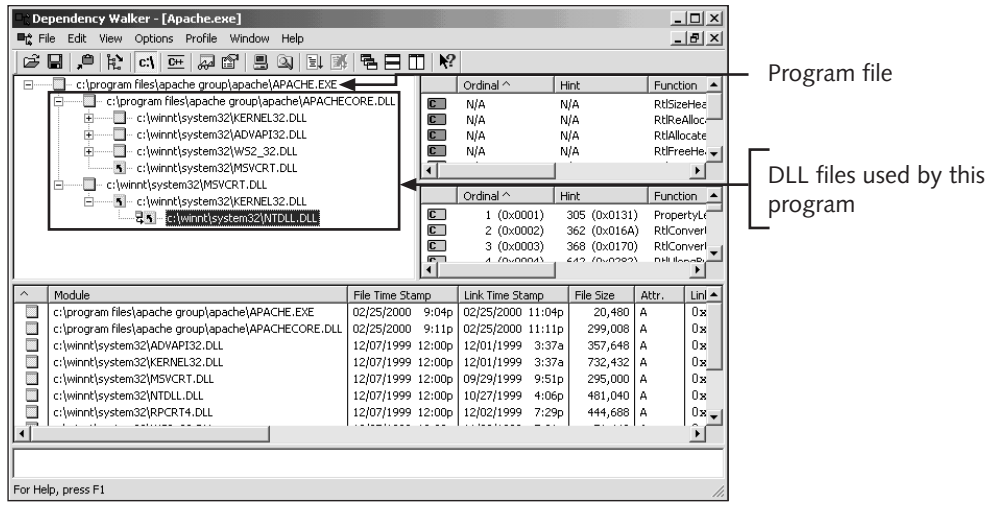


Figure 14-31 You can use dependency Walker to solve problems with applications

Other Sources of Support

Two important sources of information about Windows 2000 are the Microsoft web site at support.microsoft.com and the *Windows 2000 Professional Resource Kit* by Microsoft Press. The *Resource Kit* includes a CD that contains additional Windows 2000 utilities. These resources can further help you understand Windows 2000 and solve problems with the OS.

CHAPTER SUMMARY

- ❑ Windows 2000 is the next evolution of Windows NT with the added user-friendly features of Windows 98.
- ❑ Windows 2000 is a suite of four operating systems, each designed for a different size computer system. The suite includes Windows 2000 Professional, Windows 2000 Server, Windows 2000 Advanced Server, and Windows 2000 Datacenter Server.

- ❑ Windows 2000 Professional is designed for the corporate desktop computer and provides more security and reliability than Windows 98 and has added support for large hard drives.
- ❑ The minimum requirements for Windows 2000 Professional are 133 MHz Pentium-compatible CPU, 64 MB RAM, and 1 GB of hard drive storage. Recommended requirements are 300 MHz Pentium-compatible CPU, 128 MB of RAM, and 2 GB of hard drive storage.
- ❑ Windows 98 is recommended for home computers over Windows 2000 because it supports legacy devices and software and manages games and similar multimedia applications better than Windows 2000.
- ❑ Because of the improvements in power management over Windows 98, Windows 2000 is the recommended operating system for notebook computers.
- ❑ Windows 2000 offers several ways to deploy the OS in a corporate setting, including unattended installations and disk duplication support.
- ❑ Windows 2000 makes use of ACPI-compliant system BIOS in order to fully enable power management features.
- ❑ If a system does not have ACPI BIOS, upgrade the BIOS before you do the installation, if the BIOS manufacturer offers the upgrade.
- ❑ Network Identification, Device Manager, Dial-Up Networking, and Scheduled Tasks are some utilities that are not located on the desktop in the same places in Windows 2000 as they are in Windows 98.
- ❑ Windows 2000 supports virtual private networks so that a worker can access a corporate network from across the Internet using a secure connection.
- ❑ Windows 2000 Active Directory is a new feature of Windows 2000 that provides a centralized point of administration for all shared resources on a network.
- ❑ Windows 2000 can have more than one domain controller, whereas Windows NT can have only a single primary domain controller.
- ❑ Windows 2000 allows for printing to a URL so that you can send a print job to anywhere on the Internet.
- ❑ Windows 2000 offers a clean install and an upgrade installation. A clean install overwrites all information from previous operating system installations on the hard drive.
- ❑ Both hardware and software must be compatible with Windows 2000. Check the HCL and the Compatible Software Applications list on the Microsoft web site before beginning an installation.
- ❑ Windows 2000 supports the FAT16, FAT32, and NTFS file systems.
- ❑ Windows 2000 supports a dual boot, but each operating system must be installed in its own partition, and an application must be installed twice—once for each OS.
- ❑ A Windows 2000 upgrade installation is done in two phases, the Report phase and the Setup phase.

- ❑ Back up the Windows 2000 System State on a regular basis using the Backup utility. This backup includes system files, files to load the OS, and the registry.
- ❑ The Windows 2000 boot process works like the Windows NT process. The boot loader program is Ntldr, which gives control to Ntoskrnl.exe when the boot completes.
- ❑ Tools to use to troubleshoot problems loading Windows 2000 are the Advanced Options menu, the Recovery Console, and the Emergency Repair Process.
- ❑ Press F8 when starting Windows 2000 to access the Advanced Options menu.
- ❑ The Advanced Options menu includes Safe Mode, Safe Mode with Networking, Safe Mode with Command Prompt, Enable Boot Logging, Enable VGA Mode, Last Known Good Configuration, Directory Services Restore Mode, and Debugging Mode.
- ❑ The Recovery Console is a command interface with a limited number of commands available to troubleshoot a failing Windows 2000 load. The console requires that you enter the Administrator password.
- ❑ Access the Recovery Console by first booting from the Windows 2000 CD or from the four setup disks.
- ❑ Using the Recovery Console, you can restore the registry to the state it was in at the time of the last backup of the registry.
- ❑ The Emergency Repair Process lets you restore the system to its state at the end of the Windows 2000 installation. Don't use it unless all other methods fail because you will lose all changes made to the system since the installation. It requires the Emergency Startup Disk.
- ❑ Utilities that can help solve problems after a system loads include Chkdsk, Disk Defragmenter, Windows Update, and System File Checker.
- ❑ Windows File Protection (WFP) protects the system files against an application, virus, or user changing or deleting them.
- ❑ Windows 2000 Support Tools can be installed from the Windows 2000 CD and include several utilities to support hardware and applications.
- ❑ Sources of support for Windows 2000 include the support web site at support.microsoft.com and the *Windows 2000 Professional Resource Kit* by Microsoft.

KEY TERMS

Active Directory — A Windows 2000 service that allows for a single point of administration for all shared resources on a network, including files, peripheral devices, databases, Web sites, users, and services.

Advanced Options Menu — A Windows 2000 menu that appears when you press F8 when Windows starts. The menu can be used to troubleshoot problems when loading Windows 2000.

- answer file** — A text file that contains information that Windows 2000 requires in order to do an unattended installation.
- clean installation** — A Windows 2000 installation that overwrites all previous installations on the hard drive partition.
- console** — An administrative tool contains two or more individual administrative tools. For example, Recovery Console contains a set of commands designed to manage a failed Windows 2000 boot, and Computer Management is a console that contains several tools to monitor and manage hardware and software.
- Emergency Repair Process** — A Windows 2000 process that restores the OS to its state at the completion of a successful installation.
- Internet Printing Protocol (IPP)** — A protocol used to send print jobs across the Internet. A printer is addressed by its URL (uniform resource locator)—for example, *www.ourdomain.com/printer4*.
- mixed mode** — A Windows 2000 mode for domain controllers used when there is at least one Windows NT domain controller on the network.
- native mode** — A Windows 2000 mode used by domain controllers when there are no Windows NT domain controllers present on the network.
- Recovery Console** — A Windows 2000 command-interface utility that can be used to solve problems when the OS cannot load from the hard drive.
- Snap-in** — An administrative tool that is contained within a console. For example, Event Viewer is a snap-in in the Computer Management console.
- System File Checker** — System File Checker is part of the new Windows 2000 utility to protect system files, called Windows File Protection (WFP).
- System State data** — All files that Windows 2000 requires to load and perform successfully. The System State data is backed up using the Backup utility.
- unattended installation** — A Windows 2000 installation that is done by storing the answers to installation questions in a text file or script that Windows 2000 calls an answer file so that the answers do not have to be typed in during the installation.
- upgrade installation** — A Windows 2000 installation that carries forward all previous operating system settings and applications installed under the previous operating system.
- Windows File Protection (WFP)** — A Windows 2000 feature that protects system files from being corrupted or erased by applications or users.

REVIEW QUESTIONS

1. List the four operating systems that make up the Windows 2000 suite.
2. What are the minimum system requirements for Windows 2000 Professional?
3. What is the maximum amount of RAM that Windows 2000 Professional can support?
4. Which OS is better for home computing, Windows 98 or Windows 2000? Why?

5. What is the purpose of Kerberos?
6. What is required before Windows 2000 can provide full power management functionality?
7. What five manufacturers were responsible for the initial development of ACPI?
8. Under what circumstances must you use Windows 98 rather than Windows 2000 Professional for a personal computer OS?
9. What is a virtual private network and how does Windows 2000 support one?
10. What three file systems does Windows 2000 support?
11. Explain the difference between Windows 2000 native mode and mixed mode.
12. When you print to a printer URL on the Internet, what protocol are you using?
13. If you are installing Windows 2000 on a new hard drive and your system cannot boot from a CD, how do you begin the installation?
14. If you want to access a hard drive using either DOS or Windows 2000, what file system must you use?
15. If you install Windows 2000 on an 8 GB hard drive, use a single partition for the drive, and choose not to use the NTFS file system, what file system will Windows 2000 automatically use?
16. If your BIOS is not ACPI-compliant, what should you do before you install Windows 2000?
17. What does %SystemRoot% mean?
18. List the steps to back up the Windows 2000 System State data.
19. In what folder does Windows 2000 store a backup of the registry?
20. Which loads first, Ntldr or Ntoskrnl.exe?
21. What is the purpose of NTDetect.com in the load process?
22. What is the purpose of Safe Mode with Networking under the Advanced Options menu?
23. What is the name of the log file that Windows 2000 uses when booting in Safe Mode?
24. At what point in the Windows 2000 load process is the Last Known Good Configuration saved?
25. List the steps to load the Recovery Console.
26. Why is the Administrator password required in order to use the Recovery Console?
27. In Question 26 above, under what circumstances is the password not required?
28. What is the purpose of the Systemroot command under the Recovery Console?
29. Under the Recovery Console, what is the command that gives the same results as FDISK/MBR?
30. List the five files that make up the Windows 2000 registry.

31. Before you can perform the Windows 2000 Emergency Repair Process, what disk must you have? What is contained on the disk?
32. When would you use System File Checker? What is the command to execute it?
33. What is the command to install the Windows 2000 Support Tools?

PROJECTS



Preparing for Windows 2000

Use the Microsoft web site to research whether your home or lab PC qualifies for Windows 2000. Fill in the following table and print the web pages showing whether each hardware device and application installed on your PC qualifies for Windows 2000.

Hardware Device or Application	Specific Device Name or Application Name and Version	Does It Qualify for Windows 2000?
System board BIOS		
Video card		
Modem card (if present)		
Sound card (if present)		
Printer (if present)		
Network card (if present)		
CD-ROM drive (if present)		
DVD drive (if present)		
SCSI hard drive (if present)		
Other device		
Application 1		
Application 2		
Application 3		



Installing Windows 2000 Professional

Do the following to install Windows 2000 Professional and then test different startup options:

1. Install Windows 2000 Professional as the second OS in a dual boot with your current operating system.
2. Boot to the Windows 2000 Advanced Options Menu. Boot using each option on the menu and write a short description of what you see during and after the boot.
3. Create an Emergency Repair Disk and print the contents of the files on that disk. If the contents of a file are longer than one page, only print the first page.
4. Using the Recovery Console, copy the registry files to a backup folder on the hard drive.



Using the Microsoft Knowledge Base

Using the Microsoft support web site (support.microsoft.com), print information about the following:

1. Troubleshooting IEEE 1394 devices running under Windows 2000 Professional
2. How to set up Windows 2000 to support multiple CPUs.
3. Information on how to set up and troubleshoot multiple monitors with Windows 2000 Professional.



Using DiskProbe to Back Up the MBR

DiskProbe is a powerful disk editor similar to DEBUG, which is described in Appendix F. DiskProbe edits individual sectors on a hard drive and can edit the MBR, boot sectors, the FATs and NTFS file system tables as well as data files. Research DiskProbe and find the directions that show you how to back up the MBR, which contains the partition table. Follow these directions and answer these questions:

1. Find the document Dskprtrb.doc in the C:\ProgramFiles\Support Tools folder, which describes how to use DiskProbe. Print the page from the document that describes how to save the MBR record to a floppy disk.
2. If the Windows 2000 Support Tools are not installed, install them now.
3. Execute DiskProbe (click **Start**, point to **Programs, Windows 2000 Support Tools**, and **Tools**, and then click **DiskProbe**).
4. Follow these directions to save the MBR, including the partition table, to a floppy disk.
5. How many bytes of data are included in the MBR? What is the size of the file?
6. What is the disadvantage of using DiskProbe to restore the MBR in the event it becomes corrupted?



Creating a Windows 2000 Antivirus Boot Disk

Windows 2000 offers an antivirus program that can scan memory, the MBR sector, and OS boot sectors for viruses. Follow these directions to create the boot disk and scan your system for viruses. Use the disk when you suspect that a virus has attacked your Windows 2000 hard drive.

1. Insert the Windows 2000 CD in the CD-ROM drive and insert an empty floppy disk in the floppy disk drive.
2. Click **Start, Run**. From the Run dialog box, enter this command:
D:\VALUEADD\3RDPARTY\CA_ANTIV\Makedisk.bat
Substitute the drive letter for your CD-ROM drive for D:.
3. Label the disk Windows 2000 AVBoot.
4. Boot from the floppy disk. When the scan is completed, Windows 2000 will automatically load.

Note: If your PC is not set to boot from a floppy disk before booting from the hard drive, change the boot sequence in CMOS setup.



Using Dependency Walker

Follow these steps to use Dependency Walker to list the files used by Internet Explorer:

1. If the Windows 2000 Support Tools are not installed, install them now.
2. Execute Dependency Walker (click **Start**, point to **Programs**, **Windows 2000 Support Tools**, and **Tools**, and click **Dependency Walker**).
3. Set Dependency Walker to show all the supporting files used by Internet Explorer.
4. List the files or print the screen showing them.



Examining the Ntbtlog.txt File

Using the Windows 2000 Advanced Options menu, boot with Enable Boot Logging. Print the Ntbtlog.txt file created. Then boot with Safe Mode. Again print the Ntbtlog.txt file. Compare the two files and mark the differences. Keep these two reports in case you ever have problems booting this system since they can provide a picture of what a normal boot should be.

